REMARKS

Claims 12, 13 and 16-22 are presently pending in the Application and are rejected under 35 U.S.C. § 103(a) as unpatentable over Varela et al. `655 in view of Tanzer et al. `005 and further in view of Singer `531 for essentially the same reasons as stated in the Official Action of June 6, 2005. The Applicant acknowledges and respectfully traverses the raised obviousness rejection in view of the following remarks.

As discussed previously, the present invention is directed to a gantry axle that includes a driven differential gear unit which is connected with each vehicle wheel through an axle shaft 1 and a respective gantry transmission wherein each wheel is rotatable around an axis of rotation 12 of the vehicle wheel and rests on the ground 11. Each gantry transmission has an input spur gear 2 driven by the axle shaft 1 and operatively connected with a first intermediate spur gear 3. The first intermediate spur gear 3 is, in turn, non-rotatably connected with a second intermediate spur gear 4 and both of the first and second intermediate spur gears 3, 4 rotate around an axis of rotation 9 of the intermediate spur gears 3, 4. The second intermediate spur gear 4 is operatively connected with an output spur gear 5 which is, in turn, connected with the vehicle wheel and which rotates around the axis of rotation 12 of the vehicle wheel.

According to the present invention, the vertical spacing 15 between the axis of rotation 10 of the input spur gear 2 and the ground 11 is smaller than the vertical spacing 17 between the axis of rotation 9 of the first and second intermediate spur gears 3, 4 and the ground 11, and is smaller than the vertical spacing 18 between the axis of rotation 12 of the output gear 5 and the ground 11.

In addition, and as discussed in further detail in the following remarks, and in particular with regard to Singer `531, the input, the intermediate and the output spur gears 2, 3, 4, 5 of the gantry transmission all have helical cut teeth and a sloping angle of the helical cut teeth

of the first and of the second intermediate spur gears 3, 4 are designed so that the axial forces of the first and of the second intermediate spur gears 3, 4 are substantially neutralized.

Therefore, considering the prior art cited by the Examiner in the rejection of claims 12, 13 and 16-22, the following discussions will accept the Examiner's general interpretations of Varela et al. '655 and Tanzer et al. '005 solely for purposes of discussion and without any admission or concession regarding the relevance of teachings of the cited prior art with regard to the present invention. In general, therefore, the Examiner cites Tanzer et al. '005 as showing a differential gear unit and Varela et al. '655 as showing a gantry transmission having an input spur gear 2 driven by the axle shaft 1 and connected with a first intermediate spur gear 3 that is on a common axis of rotation with a second intermediate spur gear 4 wherein second intermediate spur gear 4 is, in turn, operatively connected with an output spur gear 5. The Examiner further cites Varela et al. '655 as showing the general vertical and horizontal spacing of the axes of rotation of the input spur gear, of the first and second intermediate spur gears, and of the output spur gear that are employed in the present invention.

The primary focus of the Examiner's rejection of the claims is again the teachings of Tanzer et al. '005 for a differential unit, an axle shaft, a gantry transmission, and a vehicle wheel attached to the output shaft of the gantry transmission. In particular, however, the Examiner cites Tanzer et al. '005 as showing a gantry transmission having an input spur gear on the input shaft and driving an output spur gear on the output shaft wherein the input spur gear is vertically closer to the ground than the output spur gear and output shaft. For purposes of the following discussions, and solely for purposes of the following discussions, the Applicant does not dispute the Examiner's interpretation of the teachings of Tanzer et al. '005 in so far as stated above.

The Examiner further states that Varela et al. '655 does not teach or suggest the use of helical cut teeth in the gantry transmission, as recited in the present claims, but further states that at column 2, lines 63-64, Tanzer et al. '005 teaches the use of helical cut teeth to provide

a high contact ratio. The Examiner further states that it would be obvious to incorporate the helical cut teeth of Tanzer et al. `005 into the teachings of Varela et al. `655, thereby disclosing the recitations of claim 14.

The Applicant respectfully disagrees with the Examiner's interpretation of the teachings of Tanzer et al. `005 and Varela et al. `655 with regard to the use of helical cut teeth in a gantry transmission of the general configuration suggested by Varela et al. `655 and used in the present invention as recited in amended claim 12 for a number of fundamental reasons.

As previously discussed, the gantry transmission of the present invention as recited in claim 12, like the gantry transmission of Varela et al. `655, employs first and second intermediate spur gears located on a common axle and connected the input spur gear, and thus the input shaft, to the output spur gear, and thus the output shaft. The spur gear arrangement of the gantry transmission of the present invention and of Varela et al. `655 thereby distributes the forces transmitted through the gantry transmission and the gear ratios of the gantry transmission between two stages, that is, between the input spur gear and the first intermediate spur gear and then between the second intermediate spur gear and the output spur gear.

In complete contrast from the present invention as recited in claim 12 and from the arrangement shown in Varela et al. `655, the gantry transmission taught by Tanzer et al. `005 does not employ and does not include any form of intermediate spur gears and the input spur gear instead drives the output spur gear directly. As such, and in a fundamental difference between the spur gear arrangement of the present invention and the gear arrangement shown in Varela et al. `655, the input and output spur gears of the Tanzer et al. `005 gantry transmission must deal with the forces transmitted through the transmission and the gear ratio through the transmission in a single step.

It will be appreciated by those of skill in the relevant arts that the requirements imposed on the various spur gear gears of the present invention and of Varela et al. `655 are

fundamentally different in kind and magnitude than those imposed on the single stage spur gears of the Tanzer et al. `005 gantry transmission.

These basic differences are further illustrated by the teachings of the present Application as compared to the teachings of Tanzer et al. `005. For example, at column 2, lines 63-64, as cited by the Examiner, Tanzer et al. `005 states that "[p]referably the teeth of pinion 76 and gear 82 are high contact ratio teeth, either helical or spur gear teeth". In other words, Tanzer et al. `005 teaches that the primary criteria is that the spur and gear teeth be high ratio teeth and whether they are helical teeth or spur teeth, which are fundamentally different from helical teeth, is essentially immaterial. As such, Tanzer et al. `005 does actually not teach the use of helical teeth in particular, but instead essentially teaches the use of high contact ratio teeth of any form.

It must also be noted that this conclusion is further supported in that because the Tanzer et al. `005 gantry transmission uses only a single stage of gearing between the input and output shafts, the teeth of the gears and spur must carry notably higher pressures and forces and must be cut to significantly different gear ratios than the teeth of the spur gears in the two gearing stage arrangement of present invention and in Varela et al. `655.

Considering by comparison the teachings in the present Application, the specification states at paragraph [012] that "[t]he toothing of the gantry transmission is preferably designed as a helical toothing, the toothing of the first and of the second intermediate spur gears being designed so that the axial forces of the first and of the second intermediate spur gears become almost neutralized." Stated another way, the use of helical teeth in the gantry transmission of the present invention is directed to an entirely different problem than in Tanzer et al. `005, that is, to reducing and preferably neutralizing the axial forces in the first and second spur gears, rather than providing greater tooth area to carry greater torque through a single stage gearing. In this regard, it should be noted that paragraph [021] of the specification indicates that the use of intermediate spur gears in the gantry transmission of the present invention

reduces the torque levels through, for example, the differential transmission, and thus through the gantry transmission, thereby allowing spur gears of smaller diameter and that carry less torque, thereby improving the ground clearance dimensions of the gantry transmission.

In summary, therefore, Tanzer et al. `005 does not actually teach the use of helical gear teeth, but actually teaches the use of gear teeth having greater contact area and thus able to carry greater loads, of which helical teeth or merely one exemplary type of gear teeth having greater contact area.

In addition, it must be noted that the present invention as recited in claim 12 is fundamentally distinguished over and from Tanzer et al. `005 because Tanzer et al. `005 suggests the use of helical tooth gears in a gantry transmission having only a single stage of gearing, that is, wherein the input spur gear and shaft drives the output spur gear and shaft directly. In contrast, the gantry transmission of the present invention as recited in claim 12, and as shown in Varela et al. `655, employs a two stage gearing where the first and second intermediate spur gears on an intermediate shaft are interposed between the input spur gear and shaft and the output spur gear and shaft. As a consequence, the gearing requirements and geometries of the present invention, and of Varela et al. `655, are fundamentally different from those of Tanzer et al. `005, so that Tanzer et al. `005 is not, in fact, relevant to the present invention or to Varela et al. `655, so that it is respectfully submitted would not be obvious to combine the teachings of Tanzer et al. `005 with those of Varela et al. `655.

It is, therefore, the belief of the Applicant that the recitations of claim 12 are fully and patentably distinguished over and from the teachings of Tanzer et al. `005 and of Varela et al. `655 in view of Tanzer et al. `005 under the requirements and provisions of 35 U.S.C. § 103 for the reasons discussed above. As claims 13 and 16-22 depend from claim 12, those claims thereby incorporate all recitations and limitations of claim 12 so that claims 13 and 16-22 are also distinguished over fully distinguished the teachings of Tanzer et al. `005 and Varela et al. `655 in view of Tanzer et al. `005 under the requirements and provisions of 35 U.S.C. § 103 for

the reasons discussed above. The Applicant, therefore, respectfully requests that the Examiner reconsider and withdraw all rejections of the claims under 35 U.S.C. § 103 over Varela et al. '655 in view of Tanzer et al. '005.

Now considering the teachings of Singer '531, and the rejection of claims 12, 13 and 16-22 over Varela et al. '655 in view of Tanzer e tal. '005 and further in view of Singer '531, the Examiner cites Singer '531, and in particular at column 3, lines 59-68 of Singer '531, as teaching sloping the angle of the gear teeth of the intermediate gears to that the axial forces of the intermediate spur gears are substantially neutralized.

The Applicant respectfully disagrees with the Examiner for the reasons, noting that the specific recitation from the present Application is that "a sloping angle of the helical cut teeth of the first and of the second intermediate spur gears (3, 4) are designed so that the axial forces of the first and of the second intermediate spur gears (3, 4) are substantially neutralized".

Referring first to the specific citation at column 3, lines 59-68 of Singer '531, this reference therein describes that the intermeshing teeth of the pinion and ring gears coupling the input and output shafts are slightly misaligned when the vehicle is at less than full load and that this misalignment of the gear teeth is due to misalignment of the input and output axles. Singer '531 further states that as the vehicle approaches full load the misalignment of the gearing teeth decreases, as does the misalignment angle between the input and output axles, so that the stresses in the axles is reduced without causing excessive wear on the gears.

It is, therefore, necessary to note certain fundamental distinctions between the present invention and the teachings of Singer '531.

For example, and as also discussed above with regard to Tanzer et al. '005, the Singer '531 does not even have any form of intermediate gears analogous to the first and of the second intermediate spur gears 3, 4 of the present invention as recited in the claims. In addition, the Singer '531 gantry transmission does not have spur gears; the input axle instead drives a pinion gear which, in turn, engages the teeth on the inner circumference of a

ring gear mounted on the output axle. As discussed above with regard to Tanzer et al. `005, therefore, the gearing requirements and geometries of Singer `531 are fundamentally different from those of the present invention, so that it would not be obvious to combine the teachings of Singer `531 with the teachings of Varela et al. `655.

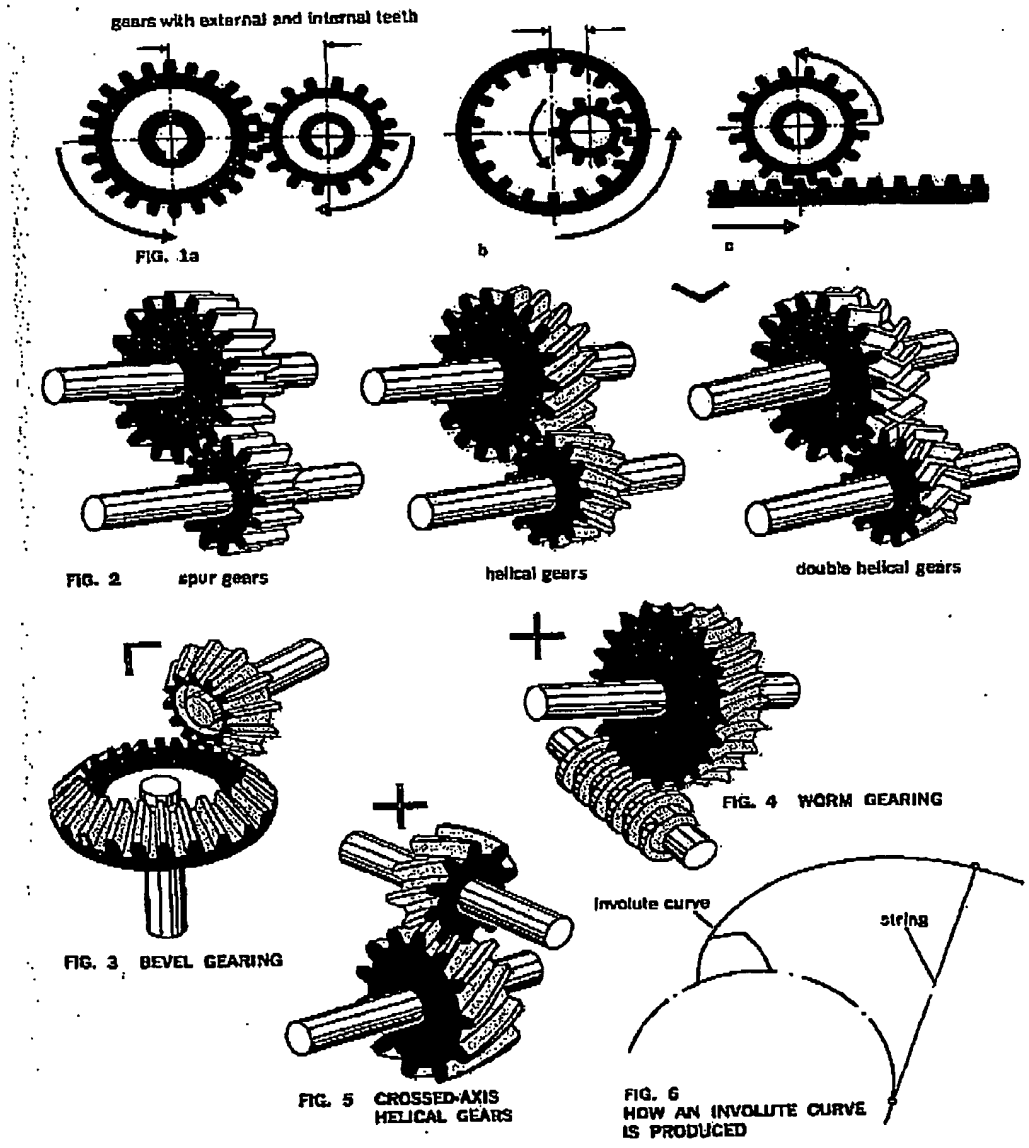
In further distinction between the present invention and Singer `531, it must also be noted that the present invention recites that the input and output spur gears 2, 5 and the intermediate spur gears 3, 4 of the present invention, as recited in the claims, have helical teeth and those helical teeth are cut at an angle that will reduce the axial stresses in the spur gear. In basic contrast from the present invention as recited in the claims, Singer `531 merely states that having the input and output axles of the pinion gear and the ring gear at a slight angle, resulting in the misalignment of the gear teeth by the same angle, will not cause excessive wear in the pinion and ring gears, and will allow a variable relative angle between the axes of the spur and ring gears as the vehicle load varies. Not only is the reduction of gear teeth wear, as in Singer `531, an entirely different matter from reducing axial stress in the intermediate gears, as with the present invention and pending claims, but a difference in angle between the teeth of two gears because they are helical gears, as with the present invention, is a fundamentally different matter from a misalignment of the teeth of a pinion gear and a ring gear because the axles of the gears are misaligned at an angle.

In this regard, it appears that the Examiner is not giving due weight to the fundamental differences between spur and ring gears, as with Singer `531, and intermediate helical gears as with the present invention and pending claims, although this difference represents a complete and fundamental distinction between the present invention as recited in the claims and the teachings of Singer `531. First, it must be noted that Singer `531 does not, in fact, suggest sloping the angle of either the pinion gear teeth or the ring gear teeth in themselves, but instead describes only having the axle supporting the ring gear at an angle with respect to the axle supporting the pinion gear. That is, and in particular, the relevant portions of the

Singer '531 specification, which actually extends from column 3, line 19 through column 4, line 38 instead of only column 3, lines 59-68, instead describes sloping the relative angle between the input and output shafts at low load levels to thereby pre-stress the axles so that the full load stress on the axles is reduced by being offset by the pre-stressing when the vehicle is at full load. More specifically, Singer '531 describes that the input shaft 22 from the differential enters the gantry transmission housing through a faceplate 18 that, on its opposite side, mates with a gear casing 26 through which the output axle 32 to the vehicle wheel exits the gantry transmission. The mounting face between the faceplate 18 and the gear casing 26 is defined by a mounting flange 40 having a smooth face 40a and Singer '531 describes shaving the face 40a of the mounting flange 40 so that axles 22 and 32 are not parallel but are "slightly angularly misaligned" when the vehicle is not at full load, thereby "pre-stressing" the axles. The angle between the input and the output shafts decreases as the vehicle load increases, which increases the stresses on the axles, until the input and the output shafts are essentially parallel with one another at maximum load. The stresses on the axles at full load are decreased, however, because the full load stresses are offset by the pre-stressing at lower load levels.

In summary, therefore, and in complete contrast from Singer '531, the helical intermediate spur gears 3, 4 of the present invention and the input and the output spur gears 2, 5, as recited in the presently pending claims, have gear teeth that are positioned at an angle to the axis of the supporting angle. By way of supporting illustration, the Applicant submits the following illustrations of spur and helical gears extracted from page 163 of Volume Two, The Way Things Work, published by Simon and Schuster, New York, with copyright dates extending from 1967 to 1971, which is a standard reference work found in many technical libraries. As shown therein, in a helical gear the gear teeth are inclined at an angle with respect to the axis of rotation of the gear while, in fundamental contrast, in a conventional

spur gear or in a pinion gear as employed by Singer '531, the teeth are parallel to the axis of rotation of the gear.



In summary, therefore, Singer '531 employs conventional pinion gears in which the teeth are straight and parallel to the axis of the supporting axle and explicitly teaches misaligning the input and the output axles of the gantry transmission by imposing an angle on meeting faces of the parts of the transmission casing that support the input and the output axles. As a result, it is very clear that in Singer '531 the angle between the teeth of the gears is not due to cutting the teeth of the gears at an angle with respect to the axis of the supporting axle, as with conventional helical gears, but is instead due solely to a misalignment angle between the input and output axles of the gantry transmission so that the gear teeth meet at an axial angle.

It is, therefore, the belief and position of the Applicant that claim 12 and dependent claims 13 and 16 - 22 are fully and fundamentally distinguished over and from the teachings and suggestions of Singer `531 under the requirements and provisions of 35 U.S.C. § 103 for the reasons discussed above. In addition, it is the belief and position of the Applicant that it would not be apparent to one of ordinary skill in the relevant arts to combine the teachings of Singer `531 with the teachings of Varela et al. `655 for the same reasons, discussed above, namely, it would not occur to one of skill in the arts to combine Tanzer et al. `005 with Varela et al. `655 and Singer `531. More specifically, the gantry transmission of the present invention and the Varela et al. `655 gantry transmission both employ intermediate gears between the input and output gears while Tanzer et al. `005 and Singer `0531 do not have intermediate gears but instead drive the output gear directly with the input gear, so that the structures and arrangements of the gearing in these references are fundamentally incompatible.

In addition, none Singer `531, Varela et al. `655 nor Tanzer et al. `005 teaches or even suggests the use of helical intermediate gears, so that even if these references are properly combinable with one another in some way, which the Applicant denies, the result would not teach or suggest this aspect of the present invention.

It is, therefore, the belief and position of the Applicant that Varela et al. `655 in view of Tanzer et al. `005 further in view of Singer `531 is not a valid combination of art under the

requirements and provisions of 35 U.S.C. § 103 and, in any event, does not teach or suggest the recitations of claim 15, and the equivalent recitations of claim 12, under the requirements and provisions of 35 U.S.C. § 103.

In this regard, however, it must be noted that the Applicant amended claim 12 to emphasize this distinction between helical gears and the misaligned axles of the spur gears taught by Singer '531 by inserting into the language of the claim a standard definition of a helical gear, specifically as a gear wherein the gear teeth are inclined with respect to the axis of rotation of the gear. It must also be noted that this amendment does not add any new material as it is essentially only a clarifying repetition of an already existing limitation, and that for the same reason the amendment does not alter in any way the scope or subject matter of the claims, so that no additional search or consideration is required of the Examiner.

It is, therefore, the belief of the Applicant that the recitations of claim 12 and of dependent claims 13 and 16 - 22, which incorporate all recitations and limitations of claim 12, are all fully and patentably distinguished over and from the teachings of Varela et al. `655 in view of Tanzer et al. `005 further in view of Singer `531 under the requirements and provisions of 35 U.S.C. § 103 for the reasons discussed above. The Applicant therefore respectfully requests that the Examiner reconsider and withdraw all rejections of the claims under 35 U.S.C. § 103 over Varela et al. `655 in view of Tanzer et al. `005 further in view of Singer `531.

Next considering other matters raised by the Examiner, the Examiner states that the recitation of helical gears in claim 12 is "has not been claimed to be with respect to any other feature of the claimed invention". It will be noted that the amendment submitted herein above with respect to claim 12 and discussed above clarifies the relationship between te helical gear teach and other features of the claimed invention. Specifically, claim 12 and thereby claims 13 and 16 - 22 now recited that the teeth of the input, the first and second intermediate and the output spur gears (2, 3, 4, 5) are helical gears which are inclined with respect to the axes of rotation of the gears.

Finally, a review of the present invention and the cited prior art shows that none of the cited prior art references in any way teaches a gear arrangement wherein, as in the gantry axle of the present invention as described in the specification, the second intermediate spur gear 4 and the output spur gear 5 are adjacent to the mounting pad of the rim of the transmission housing. As described, this arrangement allows a greater ground clearance when the gantry axle is mounted to a vehicle.

In view of the above, the Applicant therefore elects to amend claim 18 to be directed to this feature of the present invention as representing an additional distinction between the present invention and the cited prior art. It must be noted that amended claim 18 does not add any new matter to the specification or claims as this subject matter is fully disclosed in the specification as originally filed. In addition, these recitations are based upon the recitations already present in the claims under consideration and examined, and in particular claim 12, so that neither a new search nor further consideration is required.

If any further amendment to this application is believed necessary to advance prosecution and place this case in allowable form, the Examiner is courteously solicited to contact the undersigned representative of the Applicant to discuss the same.

In view of the above amendments and remarks, it is respectfully submitted that all of the raised rejection(s) should be withdrawn at this time. If the Examiner disagrees with the Applicant's view concerning the withdrawal of the outstanding rejection(s) or applicability of the Varela et al. '655, Tanzer et al. '005 and/or Singer '531 references, the Applicant respectfully requests the Examiner to indicate the specific passage or passages, or the drawing or drawings, which contain the necessary teaching, suggestion and/or disclosure required by case law. As such teaching, suggestion and/or disclosure is not present in the applied references, the raised rejection should be withdrawn at this time. Alternatively, if the Examiner is relying on his/her expertise in this field, the Applicant respectfully requests the Examiner to enter an affidavit substantiating the Examiner's position so that suitable contradictory evidence can be entered in this case by the Applicant.

In view of the foregoing, it is respectfully submitted that the raised rejection(s) should be withdrawn and this application is now placed in a condition for allowance. Action to that end, in the form of an early Notice of Allowance, is courteously solicited by the Applicant at this time.

The Applicant respectfully requests that any outstanding objection(s) or requirement(s), as to the form of this application, be held in abeyance until allowable subject matter is indicated for this case.

In the event that there are any fee deficiencies or additional fees are payable, please charge the same or credit any overpayment to our Deposit Account (Account No. 04-0213).

Respectfully submitted,

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